REMARKS

Claims 1-17 are pending in this application.

Applicant has amended claims 1, 7, 13, and 16. The changes made herein to claims 1, 7, 13, and 16 do not introduce any new matter.

Applicant respectfully requests reconsideration of the rejection of claims 1-17 under 35 U.S.C. § 102(b) as being anticipated by *Besser et al.* (U.S. Patent No. 5,970,370). As will be explained in more detail below, the *Besser et al.* reference does not disclose each and every feature of the methods defined in independent claims 1, 7, and 13, as amended herein.

Applicant has amended each of independent claims 1, 7, and 13 to specify that the first thermal process includes diffusing nitrogen in the TiN_x layer into the layer of cobalt salicide. As discussed in Applicant's specification, the benefit of diffusing nitrogen from the TiN_x capping layer through the cobalt layer and into the cobalt salicide layer is that the nitrogen atoms prevent the cobalt salicide grains from collecting and thereby forming larger grains during initial and subsequent thermal processing (see Paragraph 26). Larger grains of cobalt salicide do not connect together within the cobalt salicide layer, and such large, unconnected grains cause poor conductivity in conventionally formed cobalt salicide layers.

The *Besser et al.* reference discloses a process for manufacturing cobalt silicide in which two capping layers are used: a first capping layer of titanium nitride (TiN) and a second capping layer of titanium. The *Besser et al.* reference does not teach any method of improving the thermal stability of cobalt salicide, and does not disclose that nitrogen in the TiN layer diffuses through the cobalt layer and into the cobalt silicide layer. Further, to the extent that the Examiner may allege that nitrogen in the TiN layer inherently diffuses through the cobalt layer and into the cobalt silicide layer, Applicant notes that the presence of the second capping layer of titanium shown in the *Besser et al.* reference significantly changes the diffusion environment relative to that in the claimed subject matter. Indeed, as stated in

the *Besser et al.* reference at column 4, lines 7-9, "[t]he titanium top layer getters the impurities from the underlying layers as well as the ambient, preventing the contamination of the cobalt layer."

For at least the foregoing reasons, the *Besser et al.* reference does not disclose each and every feature of the methods defined in independent claims 1, 7, and 13, as amended herein. Accordingly, claims 1, 7, and 13 are patentable under 35 U.S.C. § 102(b) over *Besser et al.* Claims 2-6, each of which ultimately depends from claim 1, claims 8-12, each of which ultimately depends from claim 7, and claims 14-17, each of which ultimately depends from claim 13, are likewise patentable under 35 U.S.C. § 102(b) over *Besser et al.* for at least the same reasons set forth above regarding the applicable independent claim.

Applicant respectfully requests reconsideration of the rejection of claims 1-17 under 35 U.S.C. § 103(a) as being unpatentable over *Besser et al.* in view of *Giewont et al.* (U.S. Patent No. US 6,388,327 B1). As will be explained in more detail below, the combination of *Besser et al.* in view of *Giewont et al.* does not raise a *prima facie* case of obviousness against the methods defined in independent claims 1, 7, and 13, as amended herein.

It is axiomatic that an obviousness rejection based on combination of references is proper only if the prior art would have suggested to one having ordinary skill in the art the desirability of combining the references in the proposed manner. Here, the Examiner asserts that it would have been obvious to one having ordinary skill in the art to modify the teachings of the *Besser et al.* reference to use a nitrogen rich layer of TiN as taught by *Giewont et al.* As stated on page 4 of the Office Action, "[t]he motivation for utilizing a nitrogen rich TiN layer is that it allows preventing formation of an oxynitride. (Column 5 lines 43-44)."

Applicant respectfully traverses the combination of the *Besser et al.* and *Giewont et al.* references on the ground that the requisite motivation to combine these references is lacking. At column 2, lines 33-38, the *Giewont et al.* reference states "[a]lthough possible

beneficial effects of introducing nitrogen into a self-aligned $CoSi_2$ are known (for example, improving thermal stability to agglomeration), *the involvement of nitrogen in the cobalt silicide formation process has an undesirable effect"* (emphasis added). As explained in the *Giewont et al.* reference, the diffusion of nitrogen atoms causes an undesirable oxynitride layer to form between the cobalt layer and the underlying layer of silicon (or layer of native oxide formed on the silicon) (see column 2, lines 38-41). This oxynitride layer is undesirable because it blocks the diffusion of silicon atoms into the cobalt layer, and thereby results in the incomplete formation of cobalt silicide.

In light of the strong teaching in the *Giewont et al.* reference regarding the undesirable effect of introducing nitrogen into a cobalt silicide formation process, Applicant respectfully submits that one having ordinary skill in the art would not have been motivated to incorporate a nitrogen rich layer of TiN in the process shown by *Besser et al.* If anything, Applicant respectfully submits that the *Giewont et al.* reference would have guided one having ordinary skill in the art to avoid the diffusion of nitrogen into and through the cobalt layer. As such, the requisite motivation for one having ordinary skill in the art to combine the *Besser et al.* and *Giewont et al.* references in the manner proposed by the Examiner is lacking. As such, the combination of *Besser et al.* in view of *Giewont et al.* does not raise a *prima facie* case of obviousness against the methods defined in independent claims 1, 7, and 13, as amended herein.

Accordingly, for at least the foregoing reasons, independent claims 1, 7, and 13, as amended herein, are patentable under 35 U.S.C. § 103(a) over the combination of *Besser et al.* in view of *Giewont et al.* Claims 2-6, each of which ultimately depends from claim 1, claims 8-12, each of which ultimately depends from claim 7, and claims 14-17, each of which ultimately depends from claim 13, are likewise patentable under 35 U.S.C. § 103(a) over the

combination of *Besser et al.* in view of *Giewont et al.* for at least the same reasons set forth above regarding the applicable independent claim.

In view of the foregoing, Applicant respectfully requests reconsideration and reexamination of claims 1-17, as amended herein, and submits that these claims are in condition for allowance. Accordingly, a notice of allowance is respectfully requested. In the event a telephone conversation would expedite the prosecution of this application, the Examiner may reach the undersigned at **(408) 749-6902**. If any additional fees are due in connection with the filing of this paper, then the Commissioner is authorized to charge such fees to Deposit Account No. 50-0805 (Order No. MXICP012).

Respectfully submitted,
MARTINE PENILLA & GENCARELLA, L.L.P.

Peter B. Martine
Reg. No. 32,043

710 Lakeway Drive, Suite 200
Sunnyvale, California 94085
Customer Number 25920